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THE VEGETATION OF THE EDITH STEPHENS CAPE FLATS FLORA RESERVE

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Abstract

The Braun-Blanquet approach was used to classify, describe and map the vegetation of the 3,5 ha Edith Stephens Cape Flats Flora Reserve. Vegetation patterns, species richness and life-form distribution are largely related to moisture conditions and thus to the slight variations in topography that occur in the reserve. The conservation value of the reserve is discussed.

Uittreksel

DIE PLANTEGROEI VAN DIE EDITH STEPHENS KAAPSEVLAKTE FLORARESERVAAT

Die Braun-Blanquet benadering is gebruik om die plantegroei van die 3,5 ha Edith Stephens Kaapsevlakte Florareservaat in te deel, te beskryf en te karteer. Plantegroei en lewensvorm verspreiding en soort-rykdom kan alles in verband gebring word met die beskikbaarheid van water wat weer verband hou met die effense variasies in die topografie van die reservaat. Die bewaringswaarde van die reservaat word bespreek.

Introduction

The Edith Stephens Cape Flats Flora Reserve, also known as Isoetes Vlei, is a 3,5 ha nature reserve falling under the jurisdiction of the Kirstenbosch National Botanic Gardens. The reserve is 14 km from the city centre of Cape Town, and is surrounded by land zoned for agriculture and by an urban area (Nyanga township).

The reserve was established in the late 1950s largely for the conservation of *Isoetes capensis*, a rare fern-ally that occurs in seasonal water-filled depressions on the Cape Flats. The present work was undertaken to provide an understanding of some aspects of the plant ecology of the reserve, to provide base-line data for assessing future vegetation change, to assess the conservation value of the reserve, and to determine management priorities.

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* This project was undertaken as an honours project by A. Gubb under the supervision of E. Moll. B. Campbell re-analysed the raw data and produced the present account.

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METHODS

A feature of the study area is the marked vegetation seasonality. Field work for community classification and description by the Braun-Blanquet approach (cf. Werger, 1974) was undertaken from May to September, 1978. The vegetation was mapped in November with the aid of an aerial photograph taken at the end of the winter season (September). Sixty-one relevés of 4 m^2 were collected. All vascular plants and a single algal species, *Hydrodictum africanum*, were included in the study. The plant communities were recognised for mapping guided by a key that was constructed from the final phytosociological table (Table 1). Asterisks have been used to denote all introduced species.

PHYSIOGRAPHY AND CLIMATE

There is no more than 1 m of variation in topography in the reserve. The numerous shallow depressions are water-filled in winter but dry in summer. The waters in the reserve are probably alkaline (Stephens, 1929). Soils of the higher parts are sandy, whereas those of the low-lying areas are fine sandy loams to silt loams. The climate is Mediterranean—hot, dry summers and cool, wet winters. Mean annual precipitation is 534 mm. Only 10% of the rain falls in the four driest months (December to March).

THE PLANT COMMUNITIES (Table 1)

1. **Lolium* community

   Structure: Tall (0,5 m–1 m) closed (over 50% cover) grass community; Dominant species: **Lolium multiflorum*; Differential species: **Medicago hispida*, **Rumex crispus*, **Vicia atropurpurea.*

2. *Ehrharta calycina-Pelargonium capitatum* community

   Structure: Mid-high (0,25 m–0,5 m) grass community with scattered shrubs; Differential species: *Ehrharta calycina, Pelargonium capitatum, Rumex ecklonianus, Rhus laevigata*, and *Pelargonium myrrhifolium* or *P. triste*; two sub-communities are recognised. The *Brunsvigia* sub-community (2.1) occupies a single hillock in the reserve. *Brunsvigia orientalis, Oxalis caprina, Satyrium odorum*, and *Lachenalia reflexa* were, amongst others, only recorded on this hillock. These species, **Bromus rigidus* and **Hypochoeris glabra* are differential species of the sub-community (2.2). The **Briza maxima* sub-community (2.2) is more extensive and occurs on slightly lower ground. A differential and dominant species is **Briza maxima*. Other differential species are **Lagurus ovatus, Arctotheca calendula* and **Avena barbata*. **Bromus molliformis* is a dominant in this sub-community and *Ehrharta calycina* is a co-dominant in both sub-communities.

3. *Felicia tenella* community

   Structure: Mid-high (0,25 m) grass and forb community; Dominant species: *Felicia tenella*; there are no differential species but this community is recognised by the lack of differential species of the more upland community (community 2) and also those of the more lowland communities (communities 4–6).

4. *Triglochin bulbosum* community

   Structure: Mid-high forb and low (0,1 m) grass community; Dominant species: *Trachyandra oligotrichum, Romulea tabularis*; Differential species: *Triglochin bulbosum, Sparaxis bulbifera*; this community is mainly differentiated from the following community by lack of *Aponogeton angustifolius*.

5. *Aponogeton-Sporobolus* community

   Structure: Variable—open to closed low (0,1 m) grass and forb community; Dominant species: *Sporobolus virginicus, Aponogeton angustifolius, Scirpus cernuus, Stenotaphrum secundatum* (none of these are constantly dominant); Differential species: *Diplachne fusca, Geissorrhiza juncea* (both have low constancy); this is an extremely variable community. It lacks good differential species but is distinguished from all the communities of more upland sites (communities 1–4) by the presence of *Aponogeton angustifolius.*

6. *Potamogeton-Aponogeton* vlei community

   Structure: Open hydrophyte community; Dominant species: *Potamogeton pusillus, Aponogeton angustifolius, Zostera capensis*; Differential species: *Potamogeton pusillus*.

The major environmental factor affecting vegetation pattern in the reserve is moisture. Slight differences in topography (0,05 m) affect moisture conditions. The vlei sites are generally not covered with more than 0,5 m of water in winter, have no surface water in late spring, and remain largely dry throughout summer. The upland sites (community 2), although not more than 1 m above the vlei sites, never have standing water. Communities 2 through to 6 occur on the gradient from upland to lowland (vlei) sites. Numerous transitions between communities occur. Transitional plots are included in the final phytosociological table. Community 1, the **Lolium* community, consists of introduced species which have invaded sites which might otherwise have been occupied by communities similar to communities 3 and 4 (*Felicia tenella* community and *Triglochin bulbosum* community). Thus the vegetation pattern shown in Figure 1 is largely related to slight changes in topography and to the extent of invasion of **Lolium multiflorum*.

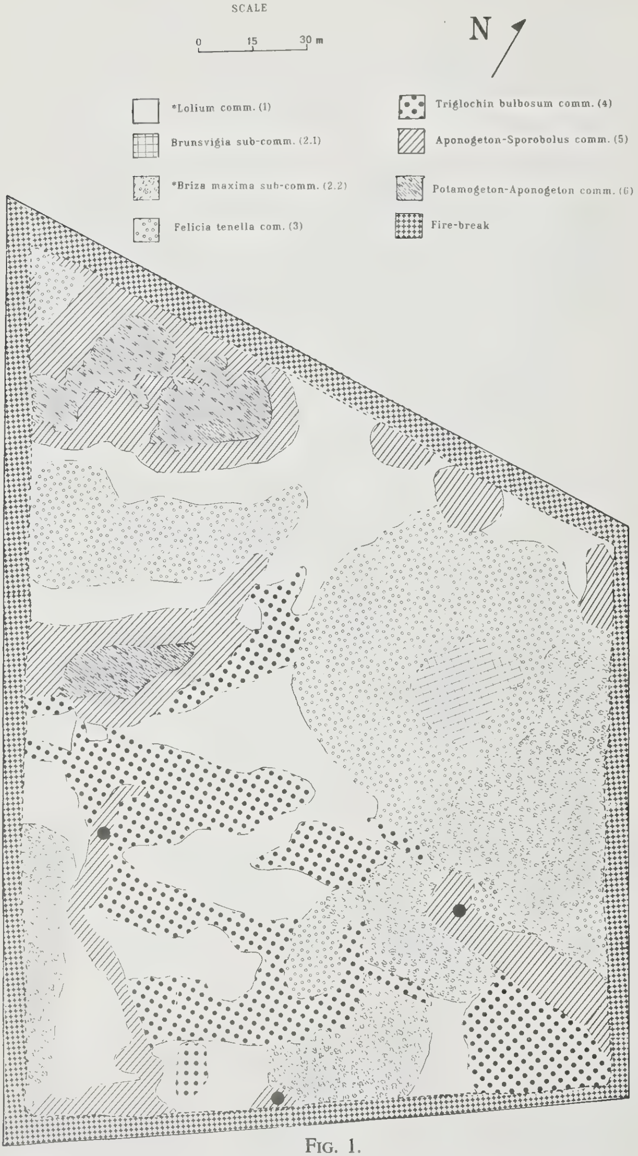
There are very few published accounts of plant communities similar to those in the reserve. Stephens (1929) provides a general account of the fresh-water aquatic vegetation of the Cape Flats. She divides the seasonal vleis and pools into

TABLE 1.

PHYTOSOCIOLOGICAL TABLE OF THE PLANT COMMUNITIES OF EDITH STEPHENS NATURE RESERVE. Infrequent species have not been included in the table (list obtainable from authors). 0 = (+)

	1												2.1			2.2										3										4						5																		6		
Relevé number	1	61	59	17	55	60	58	56	54	53	57	50	51	52	39	44	43	47	40	45	46	49	42	48	35	36	41	19	38	37	29	34	30	33	32	27	28	26	25	31	24	18	20	21	16	15	14	11	13	22	12	10	2	9	8	3	5	23	7	6	4
Number of species	16	5	6	12	8	5	5	6	9	14	5	26	28	19	36	30	28	32	38	23	29	36	27	20	28	17	18	24	23	22	18	18	18	30	19	22	21	23	23	16	12	21	16	17	24	17	9	17	12	11	20	18	16	14	17	8	15	10	4	5	10
*Medicago hispida	0	+	+		2	2	+	1	1		2										0					0									+	0										0																
*Rumex crispus	2	2	2	2	0											+			0																													0	0	0			1			1	+						0	
*Vicia atropurpurea			+			2	2	0	0	0	0														0																																					
*Bromus ? rigidus					0			0				1	+	2	+							0																																								
Oxalis caprina												1	1	0																																																
Brunsvigia orientalis												0	0	2																																																
Carpobrotus edulis												3	0	0	2										0																																					
Babiana sp.												2	1					0																																												
*Hypochoeris glabra												2	1						0																																											
Lachenalia reflexa												+	+																																																		
Satyrium odorum												+	0																																																		
*Briza maxima															+	2	3	3	+	0	+	2	1	2																																				
*Lagurus ovatus															+	+	+	+		0		+	+	+			+							+																										
Arctotheca calendula															+	+	0	+	+		+			+																																				
*Avena barbata															+	+	+	+		2				1																																				
*Euphorbia peplus															1	0	+	+			0																																							
Wachendorfia paniculata															+	+	0		+					+																																				
*Bromus diandrus															+			0	2	2																																								
*Rumex angiocarpus															2	0			0					+				0																																
Asparagus capensis																		0			1	1																																						
Ursinia anthemoides																				+	+	+	+	+										+											+															
Aspalathus niger																0	+	0																																												
Chasmanthe aethiopica																+	0																																													
Ehrharta calycina												1	3	1	2	2	0	+	+		+	+	1	0																																				
Pelargonium capitatum									0			1	0	3	1	1	0	+	+	+	0	+	+		0			+			+							0																						
Rumex ecklonianus												+	+	+	+	+	+	+	+	0	+	+	+		+	+									+	+																							
Rhus laevigata												0	0	0	1	1	0	1	1			2																					1	0																
Pelargonium myrrhifolium/triste												2	0		2	1	2	+	+	1	1	3	2		2			+						+																										
Maytenus heterophylla												0	0	0	+		+																																												
Trachyandra ciliata													0	+							+	+																																						
Cotula turbinata													2					+				+												0											0														
Crassula glomerata																							+			+				+	+	1	+	+																											
[illegible] bulbosum																											0		+				2		0																									

Lachenalia [illegible]												0	4														+				+		+																												
[illegible]															0	2								2	+	+																																			
[illegible]																																				2	+		1																						
Crassula natans															+																							+	1	2				0	+		0				0					+	+				+
Cynodon dactylon				2											1	1	1	2	0	1	1	0	2	0	2		1	1	+	+	2	+	+	0	0			2	+																						
Scirpus antarcticus																		0	+		1	+	+		1	1	1	1	+	+		1	1	1	+	+	+	0	0					+																	
*Briza minor															0	+	+	+	+		+	+	+	+		+			0	0	+	0		+	+	+	+																								
Cyperus tenellus																	+		+		+	+	0				+	2								+	+	+	+	2								2						2							
Cephalophyllum procumbens															+											2			+	+	2						2	+	0	+				0																	
Micranthus plantagineus																									2	3			+	+	+		+		+		+			+																					
Crassula decumbens																									+				+	0	1	+	3		+			1	+																						
Diplachne fusca				0																																						0	2		3						0	3	3		2		0				0
Geissorhiza juncea																																										1			2	2				2	2	+			+		+				
Isoetes capensis																																																	2		1				4						
Cotula coronopifolia																																																				0	+					+			
Mariscus riparius																																																									+	3			0
Hydrodictyon africanum																																																									+	2			3
Typha capensis																																																						0	2						
Cyperus longus	1																																																				2								
*Acacia saligna										0		+	+	+	+	0	+	+	+	+	+	0	+		0		+	+	0	+	0	0	0	+		+	+	0	0	0	0	+						0		+			+	+	0						
Stenotaphrum secundatum									0					3	1			2	+			2	0		3	3						2	2	2		+	0	+	0	+	0	1	+	3	+	+	3	3	1		0	0		2	2	1					
Laurentia secunda										0			+	0		0					+		+	0				+	+	+						+				0						0		0						+	0						
Cotula vulgaris												2			+						+	0	+	1	+				+	+	+			+				+	0						+																
Romulea rosea												1				+	+			+			0					+	+					0				+	+							+					0										
*Bromus molliformis									1	0					+	1	2	+	2	2	2	2					+	2	1	1	1	2	0	+	2	+		+	0			+			1	+	0	1	+	2			0								
Scirpus cernuus				0												+	+	0	+		+	+	0		1		1	1				1	1		0	+	+	1	+	2	2	2	3	+	+				1	2	+	2	+				2	+			
Micranthus junceus																1	+		0		+	0	+		+		+	1	0	0	1			1		1	0	+	+	1	1	2	3			+		+		2	0			0	+		+				
Ficinia indica									0	+									1		2	+	+		+	1	2	2	+	+				0		+	1			0	+	0	1	+	+			+			0	0		1	1		+				
Trachyandra ? oligotrichum				+	+					0					0								0				+		+	1	1	1	2	+	3	2	2	1	2	+	1	2	+	2	1	1		2	+	0	0	0		0					0		0
Hesperantha falcata																0	+		0		+	0		+										+	+							+			0																
Schoenus nigricans																									+	+			2	2	2		+	0		+	+	1	0	0	+	2	1	+	+			+			0	0									
Romulea tabularis				+						0			+		0				+			+	+				+	0	2	2		1	1	+	2	2	2	2	2	1	+	1	0	+	+	1		1	+	+	0	0	+			0	+	2			
Chrondropetalum tectorum																												2												0								+						+	1						
Sporobolus virginicus				1																								1					+		2	1	0	+	2	+	3	2	2	2	2	2	2	2	+		+	1		1	1		2	1	0		0
Spiloxene aquatica																																						+	+		+		+	+		2	0		+		+	0			+	0	2	2			
Crassula expansa																																						0	+			0	0				+				+	+			3	0					
Potamogeton pusillus																																																									+	2	5	1	3
Aponogeton angustifolius																			0																						+	1	2	0	1	3	1	+	2	+	+	1	1	+	2	0	2	2	0	4	2
Zostera capensis																																											0			+	0		+		0	+			1		+			2	2
Zantedeschia aethiopica			0		0	0	0	0		+	+	1	2	1	+	0	+	0	+	+	0	+	0		0		0	0	0		0			0		0	0	0	0		+	+				0		+		0	0	0	+	+	+	0					
Arthrocnemum capense																															0		+				0	1	+			+	+	0	+		+				0	0			+	2	+			2	
*Sonchus oleraceus	+			0	0																													0											0																
*Vicia hirsuta									+									0																									2																		
*Anagallis arvensis													+	+																						+	+																								
Asparagus compactus												2						0																																											
*Lavatera sp.	0																																													2							+								
Juncus kraussi																																																		3											


SCALE
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*Lolium comm. (1)
Brunsvigia sub-comm. (2.1)
*Briza maxima sub-comm. (2.2)
Felicia tenella com. (3)
Triglochin bulbosum comm. (4)
Aponogeton-Sporobolus comm. (5)
Potamogeton-Aponogeton comm. (6)
Fire-break

FIG. 1.

Vegetation map of the reserve. Sites of *Isoetes capensis* populations are shown by large dots.

marshes, lagoons, and open (i.e. not marshy) vleis and pools. Our *Potamogeton-Aponogeton* vlei community and much of our *Aponogeton-Sporobolus* community falls into her open vleis and pools category. Of our species she gives the following as characteristic: *Aponogeton angustifolius, Potamogeton angustifolius, Hydrodictum africanum, Isoetes capensis, Spiloxene aquatica*, and *Cotula coronopifolia*. All the other communities, apart from the most upland community (2), probably belong to Stephens' (1929) marsh category. She does not describe the marshes in any detail. Similar marsh communities are also recognised by Taylor (1972). He mentions such species as *Juncus kraussii, Chondropetalum tectorum, Cynodon dactylon* and *Stenotaphram secundatum*. Our upland community, the *Ehrharta calycina-Pelargonium capitatum* community, is undescribed elsewhere but is perhaps similar to Taylor's (1972) Inland Dwarf Fynbos, a type apparently found on mounds within the low-lying areas. The **Lolium* community, with its high complement of introduced species, cannot be related to communities described elsewhere.

LIFE FORMS AND SPECIES RICHNESS

The study area falls within Acocks' (1953) Coastal Macchia which is rich in phanerophytes (e.g. Acocks, 1933). In the reserve there is a relatively low percentage of phanerophytes and a predominance of the hemicryptophytic, geophytic and annual strategies (Table 2). This life-form spectrum is undoubtedly a result of (1) the very frequent fires in the reserve (the reserve has a wild fire almost every year—J. Marais, pers. comm.), and (2) the waterlogged conditions throughout summer and early spring.

TABLE 2.

Life form spectra (in percentages) of the species collected in the phytosociological survey. The life forms used are as follows: (1) P = phanerophytes: woody plants, > 250 mm; (2) C = chamaephytes: woody or sub-ligneous plants, < 250 mm; (3) H = hemicryptophytes: perennial herbaceous plants without underground storage organs; (4) G = geophytes: perennial herbaceous plants with underground storage organs; (5) T = therophytes: annuals.

	P	C	H	G	T	
Including introduced species	10	7	20	31	32	(136 species)
Excluding introduced species	12	9	28	43	8	(104 species)

The most lowland sites have a particularly short growing season for non-aquatic plants. In summer the soils are dry and hard, and in winter they are covered by water. Thus the few plants that do occur in the vleis are hydrophytes and hygrophytes (here classified mostly as hemicryptophytes, see Table 3). Species richness decreases from the upland plant communities to the lowland plant communities (communities 2 through to 6; 29 species per relevé to 6 species per relevé). The decrease is in annuals, geophytes, and phanerophytes.

TABLE 3.
Species richness by life form in each community (average number of species per relevé, with percentages in brackets)

Community No.	1	2	3	4	5	6
Annuals (T)	4,7(57)	11,6(40)	9,2(43)	7,0(34)	3,2(22)	0,6(10)
Geophytes (G)	1,5(19)	7,8(27)	5,5(26)	5,6(27)	4,6(31)	1,4(22)
Hemicryptophytes (H)	1,4(16)	5,0(17)	4,8(22)	6,5(31)	5,5(38)	4,0(63)
Chamaephytes (C)	0,2(2)	0,7(2)	0,4(2)	0,5(2)	0,6(4)	0,3(5)
Phanerophytes (P)	0,5(6)	3,8(14)	1,6(7)	1,2(6)	0,7(5)	0 (0)
Total	8,3	28,9	21,5	20,8	14,6	6,3
Average % introduced species per plot	65	28	17	15	15	5

INTRODUCED PLANT SPECIES

Introduced plant species constitute a large proportion of the flora and the vegetation. About 20 % of the species in the reserve are introduced.

The species of the **Lolium* community, including the dominant **Lolium multiflorum*, are mostly introduced annuals (Table 3). This community averages less than 4 indigenous species per relevé whereas the communities which it probably replaced average over 16 per relevé. This community covers about 25 % of the reserve (Fig. 1). Apart from the *Potamogeton-Aponogeton* vlei community, all the other semi-natural plant communities (communities 2–5) have some **Lolium multiflorum* in them. One wonders whether these communities will also be converted to **Lolium* communities.

All the communities, except the *Potamogeton-Aponogeton* vlei community. have a high percentage of introduced species (Table 3). Apart from **Lolium multiflorum*, there are numerous other dominant or co-dominant introduced grass species in the reserve, especially in community 2. They are mostly European annuals (e.g. **Briza* spp., **Avena barbata* and **Lagurus ovatus*). Introduced herbaceous species are said to be confined to severely disturbed sites in the South-Western Cape (Kruger, 1977a). Disturbance in the reserve is in the form of fire; fires occurring almost every year (J. Marais, pers. comm.). Similar introduced annuals (**Avena* spp., **Briza maxima*) occur under completely different edaphic conditions on the much-burnt Signal Hill (Moll and Campbell, 1976). **Acacia saligna* forms dense shrub communities outside the reserve and, therefore, there are numerous seedlings inside the reserve. These are continually removed by the reserve managers.

RARE PLANT SPECIES

The only species in the reserve on the threatened plant list (Hall *et al*., 1980) is *Restio sabulosus*. It is widespread in the South-Western Cape but occurs in very small populations (cf. Milewski, 1977). In the reserve the few clumps of this species are invaded by introduced grass species (**Lolium multiflorum*, **Briza maxima*).

Isoetes capensis, a rare fern-ally, was found at three sites in the reserve, all in the *Aponogeton-Sporobolus* community (see Fig. 1). *I. capensis* is found in rather temporary marshy sites in the south of the reserve. The sites were never covered with more than 150 mm of water, and generally lost their surface water rapidly. However, they remained damp for a few months as their soils have a relatively high silt component. Two of the three *Isoetes* sites appear to be in disturbed environments. One site is in the depression behind the man-made dune (made about 4 years ago) in the southeastern corner of the reserve, and the other is next to the firebreak and extends out of the reserve. This latter site appears to have been affected by the ploughing of the firebreak. The *Isoetes* population in the vlei in the northwestern corner of the reserve (E. Schelpe, pers. comm.) has apparently disappeared. Another major population used to be found on the site of the present double carriageway.

CONSERVATION VALUE OF THE RESERVE?

Is the conservation value of the reserve high enough to justify the expense of management? Will management be successful in, for example, controlling the spread of introduced grasses, and if not, should the money available for management be spent on other reserves or areas in which management will be more successful?

Questions like this indicate the need for an overall conservation policy for the South-Western Cape. At present we can only point out the conservation values of the reserve and the management policies that are necessary if the reserve is to be maintained in a worthwhile form.

The conservation value of the reserve is decreased by a number of factors:

(1) The small size (3,5 ha) and therefore the unlikelihood of the reserve being a viable ecosystem especially
    (a) as regards the lack of control of the quantity and quality of the much-needed water that enters the reserve, and secondly
    (b) the probable lack of long-term viability of many populations because of island effects. Kruger, 1977b, discusses minimum sizes of nature reserves;
(2) the dominance and spread of introduced plant species;
(3) the dense human population centre on the boundary of the reserve (Nyanga township) and therefore the disturbance of flora and fauna by the local inhabitants and their dogs;

(4) the very frequent fires and therefore the unnatural state of the plant communities.

If the reserve is to be conserved in a worthwhile state the managers will have to consider these problems.

The major value of the reserve is that it is the only area with natural seasonal open vleis and pools on the Cape Flats that is afforded conservation status. It also contains some rare species. The reserve has at least 126 indigenous plant species. Stephens (1929) suggests that the seasonal pools have a "rich amphibian, crustacean and other animal life". Preliminary check lists of plants, mammals, birds, reptiles and amphibians can be obtained from the authors, or from the Compton Herbarium, Kirstenbosch.

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